

THE CLAIMS

What is claimed is:

- 5 1. A method for forming a relaxed or pseudo-relaxed useful layer on a substrate which comprises:
- growing a strained semiconductor layer on a donor substrate;
- bonding a receiver substrate to the strained semiconductor layer by a vitreous layer of a material that becomes viscous above a certain viscosity
- 10 temperature to form a first structure;
- detaching the donor substrate from the first structure to form a second structure comprising the receiver substrate, the vitreous layer, and the strained layer; and
- heat treating the second structure at a temperature and time sufficient to
- 15 relax strains in the strained semiconductor layer and to form a relaxed or pseudo-relaxed useful layer on the receiver substrate.
2. The method of claim 1 wherein the vitreous layer is formed on the strained layer prior to bonding.
- 20 3. The method of claim 1 wherein the vitreous layer is formed on the receiver substrate prior to bonding.
4. The method of claim 1 wherein the second structure is heat treated
- 25 at a temperature that is at least about the certain viscosity temperature.
5. The method of claim 4 wherein the vitreous layer is provided by growing a semiconductor material layer on the strained layer and applying a controlled treatment to convert at least part of the semiconductor material layer
- 30 into a material which is viscous above the certain viscosity temperature.

6. The method of claim 5 wherein the semiconductor material layer comprises silicon, and the controlled treatment is a controlled thermal oxidation treatment that converts at least part of the silicon layer into a silicon oxide vitreous layer.

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7. The method of claim 5 wherein the controlled treatment forms an inserted layer between the vitreous layer and the strained layer.

8. The method of claim 7 wherein the inserted layer becomes at least a partially strained layer after the heat treatment.

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9. The method of claim 1 wherein the thickness of the vitreous layer in the first structure is about between 5Å and about 5000Å.

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10. The method of claim 9 wherein the thickness of the vitreous layer is about between 100Å and about 1000Å.

11. The method of claim 1 which further comprises growing a strained semiconductor layer on the useful layer.

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12. The method of claim 1 which further comprises applying a bonding layer of material onto at least one of the vitreous layer, the receiver substrate or the strained layer prior to the bonding step.

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13. The method of claim 12 wherein the bonding layer comprises silicon oxide.

14. The method of claim 1 which further comprises providing a zone of weakness in the donor substrate so that the donor substrate can be detached along the zone of weakness.

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15. The method of claim 14 wherein the donor substrate is fabricated by forming a porous layer on a crystalline carrier substrate and growing a crystalline layer on the porous layer, such that the porous layer comprises the zone of weakness of the donor substrate.

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16. The method of claim 14 wherein the donor substrate is detached along the weakened zone by at least one of chemical etching or mechano-chemical etching.

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17. The method of claim 14 wherein the zone of weakness is formed by implanting atomic species in the donor substrate.

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18. The method of claim 14 wherein the donor substrate is detached along the zone of weakness to form a third structure comprising the receiver substrate, the vitreous layer, the strained layer and a layer of donor material, and wherein the layer of donor material is removed before heat treating the third structure.

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19. The method of claim 1 wherein the vitreous layer is of an electrically insulating material.

20. The method of claim 1 wherein the vitreous layer comprises silicon oxide.

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21. The method of claim 1 wherein the donor substrate comprises silicon and the strained layer is made of a $\text{Si}_{1-x}\text{Ge}_x$ material.

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22. The method of claim 1 wherein the viscosity temperature of the vitreous layer is greater than about 900°C and the heat treating occurs at a temperature above about 900°C to about 1500°C.

23. The method of claim 1 further comprising fabricating optic,
electronic or optoelectronic components in the useful layer.

24. The method of claim 11 further comprising fabricating optic,
5 electronic or optoelectronic components in the strained semiconductor layer.